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ABSTRACT

It has been observed that some American students develop disorders of communication when learning a foreign language by the audiolingual method. Such disorders take various forms - "word deafness," articulatory defects and deviations in vocal quality. A project to study these phenomena began in 1959 at Purdue University. One study examined the relation between auditory discrimination abilities and learning French. Ninety-one students studying French for the first time were tested in successive semesters. Mimicry tests and sound discrimination tests were administered, and their relationship to learning French pronunciation analyzed. A second phase studied prediction of academic achievement in first-semester college German. Intellectual and non-intellectual data were used to predict success in German courses and use of a battery of variables gave accurate predictions at B, C, and D grade levels of success and for possible class placement. Abstracts of several articles and theses on the psychology of learning are included. They discuss effects of changes in presentation, differences in auditory discrimination values and characteristics and varying word associative latency on recall, memory and serial learning. (CHK)

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Disordered Communication Processes Associated With Foreign Language Learning

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NATIONAL INSTITUTE OF EDUCATION

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DISORDERED COMMUNICATION PROCESSES ASSOCIATED WITH FOREIGN LANGUAGE LEARNING

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HISTORY OF THE PROJECT

"It has been observed that a limited but significant number of American students, normal speakers in their native language, develop disorders of communication when learning a foreign language by the audio-lingual method. Such disorders take various forms--"word deafness" and other problems of audition, simple articulatory defects, the blockages and repetitions characteristic of stuttering, and deviations in vocal quality--which are consistent with the symptoms of speech and hearing disorders commonly referred to speech and hearing clinics. It appears that these "foreign language speech disorders" do not carry over into the native American speech of the students affected, but this observation has not been validated.

"A noteworthy feature of the study will be the employment of three trained and experienced speech pathologists from abroad: one Spanish, one French, and one German. These persons will be charged with the responsibilities of speech and hearing diagnosis and therapy. In addition, three graduate research assistants in psychology will be assigned to the project."

The above problem, which became the subject of Contract SAE 8408 on June 23, 1959, was jointly devised by Professors M. D. Steer and Elton Hocking, who were then Director of the Speech and Hearing Clinic and Head of the Department of Modern Languages, respectively. Spending the summer in Europe, Dr. Steer tried unsuccessfully to recruit the Spanish, French, and German speech pathologists. "Both a severe shortage of trained personnel and previous commitments made it impossible to secure any of these therapists to start in September," he reported. Eventually an Austrian graduate student was engaged. He sailed immediately after taking his doctor's degree, arriving at Purdue University in March, 1960. Subsequently, Mr. John Howie, a former student of Professor Pierre Delattre, was engaged. He began his work on the project in June, 1960.

The various misfortunes and delays necessitated changes in plans: work with students of Spanish could not be undertaken; there was a shift of emphasis from psychoacoustical to psychological investigations; new studies in the prediction and evaluation of student achievement were added; the terminal date of the contact was postponed. Supplemental agreements with the Office of Education finally set the terminal date as December 31, 1962. It was further agreed that the report of the Austrian therapist, from whom no satisfactory report has been received, would be submitted subsequently as an appendix to the present report.

The psychological studies were begun on schedule, and the five reports on them constitute an important part of this document. Four of the reports represent Masters' theses. In addition, fourteen subsequent investigations are in progress in the Department of Psychology, three of them as Ph.D. theses. An interesting observation was reported by Professor Weisiger on April 24, 1961:

> "Probably the most significant finding thus far is the indication that the same variables do not seem to operate in aurally-presented material as operate in visually-presented materials. . . . Retention of the less intelligible words is impaired."

The opening of new avenues and the stimulation to further research may prove to constitute the major contribution of the present Project.

AN EXPERIMENTAL STUDY OF THE RELATION BETWEEN AUDITORY DISCRIMINATION ABILITIES AND THE LEARNING OF FRENCH PRONUNCIATION

INTRODUCTION

New speech habits presuppose new listening habits--not only new habits of listening to another person speak but also of listening to oneself speak. It is now an accepted fact that all speech is continuously monitored and controlled by the speaker's hearing center. [2]. Speech therefore can not be considered separately from hearing, and any discussion of speech habits requires a discussion of listening habits.[6].

It is well known that, before adolescence, children have a special gift for mimicry and are more adept at learning languages than most older children and adults. One may say that their listening and speech habits are not yet fixed. A child's self-monitor control system is still flexible enough--in a manner of speaking--to allow him to imitate unfamiliar speech patterns easily and accurately. An adult, on the other hand, has formed listening-speech habits that are usually very difficult to change--even to the extent of being able to mimic a different dialect of his own language. Speech therapists consider that the greatest hurdle in correcting a person's speech is the initial step of inducing him to make any change whatsoever, and this is usually possible only after the speaker has learned to hear the difference between his mistakes and the desired sounds.

One may expect, then, that to teach adults to master the sounds of a foreign language will be difficult and all the more so when the two languages involved are as contrasting phonetically as English and French. The difficulty is familiar enough to all high school and college foreign language teachers and may be stated thus: most language students are unequipped psychologically and physiologically to make automatic changes in their listening-speech habits. There is, of course, noticeable variation: some students seem totally incapable of hearing or producing a new sound; and few seem to possess a "golden ear" for language--whatever that is. The question is, what produces this variation? Are special auditory abilities involved in the ability to learn new listening-speech habits? If so, would group testing of such abilities be used to predict success in learning to pronounce French, for example?

The Plan of Research

A preliminary investigation was made at Purdue University during the academic year 1960-1961 to determine what, if any, relationships exist between certain auditory abilities in beginning French students and the ability of these students to learn certain new listening-speech habits. Correlations were made between auditory discrimination scores and mimicry performance ratings for 91 first-year French students who completed the series of tests. Students who had been exposed to the French language previously were eliminated from the subject group. The remaining subjects were students in the same course at the same time, learning the same material with the same methods of instruction. Half of the scheduled class time of four

hours per week was devoted entirely to listening practice and oral drill presented on tape recordings. The first ten weeks of the course consisted of a rather arduous pre-reading experience.

The auditory abilities tested were (1) sense of rhythm, (2) tonal memory, and (3) speech sound discrimination. The first two of these are also musical abilities, and they were tested by standard measures of musical talent. Speech sound discrimination is a rather complex ability and was tested by means of two recently developed measures. All persons with normal hearing acuity learn at an early age to make rather fine discriminations in the primary psychological aspects of sound: duration, loudness, pitch, and timbre. Some of the finest of these discriminations are involved in learning to recognize and to reproduce the patterns of rhythm, stress, intonation, and vowel and consonant quality of our mother tongue. Even though all persons learn the same set of responses to the same dialect, normal individuals do differ in the speed and accuracy with which they learn to respond to the discriminations of spoken language. An individual's ability to discriminate the sounds of speech is thus measured by testing the responses he has already learned to make in his native language.

The most promising method now in use for measuring a student's pronunciation of a foreign language is to elicit a spoken response by an auditory stimulus alone; the student is instructed merely to mimic what he hears. [5]. Some advantages are that the student's familiarity with the written forms is not involved and that the same test can be repeated from time to time with a minimum of practice effect. The stimulus material consists of phrases in the foreign language which include characteristic patterns and individual features. The student's recorded responses are then judged by playing them repeatedly and scoring only one pattern or feature at a time. A simple mimicry test in French was designed for this study, to be administered once near the beginning of the year and once near the end of the year.

EXPERIMENTAL TECHNIQUE

Constructing the Mimicry Test

The basic purpose of testing beginning French students' mimicry performance was not to measure proficiency in reproducing every speech sound and pattern in the French language but rather to measure ability to imitate French pronunciation in a limited number of representative sounds and patterns which require the student to make fairly gross distinctions between the phonetic characteristics of English and French. For English-speaking subjects, French is ideally suited to this purpose, since its phonetic characteristics are diametrically opposed to those of English. Delattre has described how these contrasting characteristics can be reduced to phonetic modes: the tense mode of French articulation opposing the lax mode of English articulation; the front mode of French articulation opposing the back mode of English articulation; and the increasing mode of French syllabication opposing the decreasing mode of English syllabication. [4]. Such gross contrasts provide the naive student with a wide range in which to make the necessary new auditory discriminations and in which to produce sound patterns which are contrary to his native linguistic habits.

The representative sounds and patterns of French used in constructing the Mimicry Test were selected and arranged into sentences with two criteria in mind: (1) that the material be unfamiliar to the subjects in order to eliminate distracting effects of specific course material which they had practiced and (2) that each sentence be quite short in order for all subjects to be able to repeat it easily--since the test is of mimicry ability rather than of memory span. The length of the sentences was therefore limited to six syllables which may be uttered in the 0.8 seconds which has been found to be the limit of the "conscious present"--that is, the maximum period of time which may be perceived as a unit. [1].

Each sentence was designed to exemplify one basic intonation pattern, one rhythm or accent pattern, and three characteristics of vowels or consonants. The Mimicry Test consisted of four sentences, each one a reasonable approximation to spoken French but meaningless in this context:

1. Dis-tu la goulue?
2. Posez un peu ces pots.
3. C 'etait elle qui tapait.
4. Jeanne demande une malle.

A tape recording was made of these sentences, pronounced as naturally as possible by two speakers, male and female. The speakers were a French professor with virtually perfect pronunciation and a native Frenchwoman. Each sentence was spoken four times in succession, and a fifteen-second pause was inserted between the different sentences. Each sentence was repeated in a different sequence of speakers, chosen at random.

Administering the Mimicry Tests

Because of delays in completing the new language laboratories at Purdue, it was necessary to give the first Mimicry Test to French 101 students one at a time from the beginning of the fall semester through the middle of it. This was done mostly during the students' scheduled laboratory periods, taking students individually to a recording studio in the department. The model sentences for mimicry were played to the subject through the loudspeaker of a VM tape recorder at a normal listening level. The subject's responses were recorded with an Ampex 601 recorder.

The second Mimicry Test was given during the first week of May to the same classes, which were then completing French 102. The test was administered in the new labs to 20-40 students simultaneously, using Stancil-Hoffman tape recorders with activated earphone systems. The recordings of the subjects' responses were then copied in sequence onto one continuous tape.

In administering both Mimicry Tests I and II, appropriate comments were given about the nature of the test and the task to be performed. During the fifteen-second pause after the fourth utterance of each model sentence, the subjects were to speak that sentence twice, imitating it as closely as possible. The second utterance was intended to give the subject a chance to improve on the first one, if he was not satisfied with it. In rating the subjects' performances, the judges gave

credit to the better of the two responses, for a given feature. Before hearing and repeating the four sentences of the test itself, the subject recorded his name and practiced mimicking two similar sentences presented in the same manner as those of the test.

Judging the Mimicry Tests

First, the recordings of the subjects' responses to the four model sentences were selectively copied onto four different tapes. Each of these tapes contained only one of the sentences as uttered by all the subjects, each one first saying his name. The judges worked together as a group, discussing each sentence and agreeing on the rating criteria before judging the responses. The tapes were played back on a Magnecorder through earphones in order to exclude outside noises. The judges listened to each tape five times, rating one feature each time.

Rating scales were prepared for each of the five features to be judged in each of the four sentences. These scales were constructed in terms of descriptive phrases rather than numerals and required the judge merely to place an "x" at any point along a five-and-one-half-inch continuum. All the scales were arbitrarily divided into seven points with identical anchor points: "beautiful French" at the left and "no response" at the right. To facilitate judging a large number of subjects in succession, the subjects' names were listed vertically on separate sheets of paper, each name followed by a five-and-one-half-inch line. While listening to the tapes, the judge simply moved his rating scale down the sheet of subjects from one name to the next, establishing positive identification of subjects as they spoke their names.

The following are the twenty features of the Mimicry Test rated by the judges, together with the five descriptive points on each rating scale which were agreed upon as guides. The first point was intended as a description of the model utterance which the subject was asked to mimic. To the right are the anticipated pronunciations by American beginning students of French, ranging from slight errors to the worst possible imitations of the model. The anchor point "no response" was also appropriate when the subject failed to utter an entire sentence, thereby omitting the feature in question.

DIS-TU LA GOULUE?: INTONATION

rising very high	rising high (Amer.)	rising slightly	monotone (nearly)	falling group

DIS-TU LA GOULUE?: RHYTHM AND ACCENT

equal loudness	lue loudest	tu loudest	dis or gou loudest	too many, few syll.

DIS-TU LA GOULUE?: VOWEL DIS

[i] front spread lips	[i] Amer. "beet"	some diphthong	less front "bit"	bad diphthong

DIS-TU LA GOULUE?: VOWEL TU

[y] front protruding	less front [ɸ, œ]	unrounded "beet"	back "boot"	[ə, ər] "bert"

DIS-TU LA GOULUE?: VOWEL LUE

[y] front protruding	less front [ɸ, œ]	unrounded "beet" ("book")	back "boot" "but"	[ə, ər] "bert"

POSEZ UN PEU CES POTS!: INTONATION

falling very low	falling low (Amer.)	falling slightly	nearly m. notone	rising group

POSEZ UN PEU CES POTS!: RHYTHM AND ACCENT

equal loudness	sez louder	peu louder	sez and peu louder	too many, few syll.

POSEZ UN PEU CES POTS!: PLOSIVES

not aspirated	slightly aspirated	badly aspirated	1 cons. substitute	2-3 cons. substitute

POSEZ UN PEU CES POTS!: VOWEL SEZ

tense [e] spread lip	tense [e] not spread	less tense	some diphthong	bad diphthong

POSEZ UN PEU CES POTS!: VOWEL POTS

tense [o] protruding	tense [o] rounded	less tense	some diphthong	bad diphthong

C'ETAIT ELLE QUI TAPAIT.: INTONATION

elle very high	elle high	slightly high	both falling	elle falling
pait very low	pait low	and low	OR rising	pait rising

C'ETAIT ELLE QUI TAPAIT.: SYLLABIC INTONATION: ELLE, PAIT

both on 1 note only 8	slight change	some change	one syll. bad change	both syll. bad change

C'ETAIT ELLE QUI TAPAIT.: RHYTHM AND ACCENT

elle, pait very long	more long than loud	more loud than long	elle, pait very loud	too many, too few syll.

C'ETAIT ELLE QUI TAPAIT.: PLOSIVES

[ptk] not aspirated	slightly aspirated	badly aspirated	1, 2 cons. subs. or omit	3-5 cons. subs. or omit

C'ETAIT ELLE QUI TAPAIT.: DENTALS

[st l] dental	[st l] partly	alveolar	[l] becomes [U]	[l] becomes [r]:
[st] lower	dental	(Amer.)		[ɔr]

JEANNE DEMANDE UNE MALLE.: INTONATION

falling very low	falling low (Amer.)	falling slightly	nearly monotone	rising group

JEANNE DEMANDE UNE MALLE.: RHYTHM AND ACCENT

malle released	equal loudness	malle louder	man louder	too many, few syll.

JEANNE DEMANDE UNE MALLE.: VOWEL JEANNE

completely oral	nearly oral	changes oral-nasal	nearly nasal	completely nasal

JEANNE DEMANDE UNE MALLE.: VOWEL MAN

nasal, no [n]	nasal, some [n]	nasal, bad [n]	some [l] [maU]	bad [l] [maɪ]

JEANNE DEMANDE UNE MALLE.: VOWELL MALLE

completely oral	nearly oral	changes: nasal-oral	[l] becomes [U]: [maU]	[l] becomes [n]: [mãn]

Seashore Measures of Musical Talents

This well-known set of tests has been available on phonograph records for nearly a generation and has been widely used in schools of music and college psychology courses. [9]. It has always been assumed that the discrimination abilities which it measures are those involved in speech as well as in musical skills. [10]. Over the years, these tests have been employed in numerous studies of speech perception ability, with more or less convincing results.

More recent investigators have concluded that the Seashore tests do not tell us much about the auditory discrimination abilities essential for learning speech habits. [8]. Nevertheless, certain of the tests pose tasks which are obviously related to the demands of speech in any language. Two of them, the test of sense of

rhythm and the test of tonal memory, were included in this study to see what relation they would bear to mimicry performance in French rhythm and intonation, respectively.

The test of sense of rhythm consisted of 30 trials of a same-or-different discrimination, employing pairs of short rhythmic patterns tapped out on a small drum. The test of tonal memory consisted of 30 trials in which the subject had to tell which note was changed in the repetition of pairs of short melodic patterns--ten of three notes, ten of four notes, and ten of five notes. The stimuli taps and tones of both tests were copied from the discs onto a tape recording, each test preceded by four practice examples drawn at random from the stimuli of the test. The playback time of the complete tape was thirteen minutes, exclusive of the time given to instructions before the second test.

These tests were administered in the new labs midway in the second semester. Mimeographed answer sheets were prepared, giving instructions and the four practice examples marked correctly for each test. Instructions were also spoken orally by the experimenter, and the students were given a chance to ask questions. The tests were scored by means of a template key, and percentage scores were recorded for each test.

Delattre Test of Vowel Recognition

This test employs synthetic vowel sounds as stimuli. The vowel-like tones were produced by converting hand-painted spectrographic patterns into sound with the pattern playback instrument at the Haskins Laboratories in New York. It has been established that intelligible vowels can be synthesized with only two formants (frequency regions of greatest acoustic energy). [3]. For this test, Delattre chose seven English vowels, of which three sets of two-formant patterns were prepared and converted into sound. From one set to the next, the patterns were increasingly simplified so that the number of harmonics making up each formant decreased from the first set to the last. Set One had three harmonics per formant, giving a total of six tones for each vowel sound. Set Two had two harmonics per formant, giving a total of four tones for each vowel sound. Set Three had only one harmonic per formant, giving a total of two tones for each vowel sound. Vowels having the fewest tones are the least intelligible, and so discrimination becomes more and more difficult as the subject passes from set to set in this test. The underlying assumption is that individuals who can best comprehend a highly simplified acoustic event can also best comprehend the new sounds of a foreign language.

The seven synthetic vowels, illustrated in the following "key words": beet, bit, bet, bat, bought, but, boot, were recorded with each vowel appearing twice in each set in random order. Thus the test consisted of a total of 42 stimuli. Further, each stimulus was presented as a series of four "notes", of half a second duration, with a half-second pause between the notes. The different stimuli were separated by an interval of about five seconds. For use in the present study, an additional pause of five seconds was inserted after every seven trials to help the subjects to keep their places. Also, seven examples were recorded on the tape before the first set, representing each of the seven vowels, and drawn from all three sets. These examples were always identified in order to familiarize the subjects with the range of vowel-like sounds in the test. The total playback time of the tape was ten minutes.

This test was likewise administered in the new labs, near the middle of the second semester. The subjects responded by marking one of the seven key words printed for every stimulus on their answer sheets. These sheets gave instructions and the seven examples, identified by being marked as the subjects' responses should be made. As in the Seashore tests, instructions were given orally as well; and the students were encouraged to ask questions. The Delattre Vowel Test was also scored by means of a template key, and percentage scores were recorded.

Fairbanks Test of Phonemic Differentiation

This recent test, also known as the Rhyme Test, was developed at the Speech Research Laboratory of the University of Illinois for the study of speech reception. In his first published description of the test, Fairbanks states:

> "The test was motivated originally by need for experimental materials in which: (1) the spoken word would be the stimulus unit. (2) recognition of the word would be the response; (3) the response would depend upon the initial consonant and consonant-vowel transition; and (4) the subject's task would bear valid relation to the discrimination demands of real speech. . . . The Rhyme Test is of the completion type. The stimulus words are drawn from the vocabulary of 250 common monosyllables shown in Table I. This vocabulary consists of 50 sets of five rhyming words each. To yield a single 50-item form, one word is drawn from each set. In the table, the sets are shown in a usable random order that is the same for all forms. . . . .
> "Within a set the five rhyming words differ in the initial consonant phoneme, in each case an element. The words of a set are also spelled alike in the rhyming portion ("stem") and differ in the initial consonant spelling, in each case a single letter. Each spelled stem is unique. The subject's response sheet shows the 50 stems in order of stimulus, each preceded by a space in which he enters one letter to complete the spelling of the word (e.g., --ot, --ay, --op). Copies of the same response sheet serve for different forms. [7] .

The five forms of 50 words, shown in Table II, were recorded on tape, each word spoken once, with one word uttered every five seconds. Noise (0-20,000 cps) from a Grason-Stadler generator was also recorded on the tape at a vowel-to-noise ratio of -2 decibels. This means that the masking noise was loud enough to make word identification quite difficult. In previous work using this V/N ratio, the mean percentage correct was about 52 for about 80 subjects, with a range from about 30 to about 76 per cent. The recording of each 50-word form was about five minutes long, giving a total playback time of somewhat less than half an hour.

This test was administered in the new labs during the second semester, not in scheduled lab periods but by appointment when students had free hours. The five forms were administered in a single series with a brief rest between forms. The subjects were provided with five identical response sheets which included the necessary instructions. The instructions were paraphrased by the examiner to assure that all subjects were prepared for their task. The Rhyme Test forms were scored by means of template keys, and percentage scores were recorded for the entire test.

TABLE I. Stimulus vocabulary of Fairbanks Rhyme Test

	RT-1	RT-2	RT-3	RT-4	RT-5
1.	hot	got	not	pot	lot
2.	pay	may	day	way	say
3.	top	hop	pop	mop	cop
4.	peel	reel	feel	heel	keel
5.	wake	take	make	cake	lake
6.	law	saw	jaw	paw	raw
7.	vile	mile	file	tile	pile
8.	neat	seat	beat	heat	meat
9.	look	cook	hook	took	book
10.	fill	kill	will	till	bill
11.	tire	hire	sire	fire	wire
12.	male	tale	sale	pale	bale
13.	sent	rent	went	bent	tent
14.	moon	noon	coon	boon	soon
15.	kick	sick	lick	tick	pick
16.	same	fame	name	came	game
17.	wide	tide	side	ride	hide
18.	rip	dip	lip	hip	tip
19.	sore	bore	tore	more	wore
20.	bang	hang	sang	gang	rang
21.	men	den	hen	pen	ten
22.	park	bark	lark	mark	dark
23.	coil	foil	boil	soil	toil
24.	big	wig	dig	fig	pig
25.	rage	cage	page	sage	wage
26.	cast	past	fast	last	mast
27.	gain	pain	main	rain	vain
28.	nest	west	test	best	rest
29.	gun	nun	run	sun	fun
30.	heal	deal	seal	zeal	meal
31.	sin	win	tin	din	pin
32.	bust	just	must	rust	dust
33.	fine	mine	wine	nine	line
34.	mink	link	pink	wink	sink
35.	sold	told	hold	cold	gold
36.	hit	sit	wit	fit	bit
37.	led	bed	red	wed	fed
38.	tend	send	bend	lend	mend
39.	rid	bid	kid	did	hid
40.	back	lack	pack	jack	sack
41.	tail	sail	mail	nail	fail
42.	fight	light	right	might	night
43.	torn	worn	born	horn	corn
44.	rod	god	cod	sod	nod
45.	dock	mock	cock	lock	rock
46.	bump	pump	lump	dump	jump
47.	date	rate	gate	late	hate
48.	well	fell	tell	bell	sell
49.	set	let	get	yet	met
50.	luck	tuck	duck	suck	buck

Data and Analysis

The Mimicry Test ratings were recorded from the position of the judges' "x's" on the subject sheets, in terms of numbers 1 through 7. The number 1 represented the rating "no response", and the higher numbers represented the successive descriptive phrases on the rating scales. Judgments falling midway between the descriptive phrases were arbitrarily recorded as 1.5, 2.5, etc. The data from Mimicry Tests I and II, together with the data from the four discrimination tests, were punched on IBM cards, using one card per subject and four additional sets of cards for tabulating the scores given by the four judges on the various parts of the Mimicry Tests.

In order to discover whether there was a significant difference among the ratings of the four judges who began judging Mimicry Test I, an analysis of variance was performed on the data for the ten features rated by the four judges. Since the tapes of Mimicry Test I contained the responses of 199 students, the sample size for this analysis of variance consisted of a total of 7,960 observations. This sample size was roughly equivalent to that which would have been obtained if the four judges had rated all twenty features of Mimicry Test I for the 91 subjects who completed the experiment. (Because of the time involved, three of the judges were obliged to stop work by the time the judging of Mimicry Test I was completed.)

In general terms, two basic questions were posed of the data from the Mimicry Tests and the discrimination tests: (1) What relations are there between the different discrimination tests and Mimicry Test I (which probably indicates only mimicry ability per se), and (2) what relations are there between the different discrimination tests and progress in learning French pronunciation, as indicated by the differences between Mimicry Test I scores and Mimicry Test II scores. To answer these questions in reasonable detail, eight separate multiple correlations were planned, each of which would include the four discrimination tests as independent variables. The eight dependent variables were to be Intonation ratings, Rhythm ratings, Vowel ratings, and Consonant ratings, all from Mimicry Test I, and Intonation Progress, Rhythm Progress, Vowel Progress, and Consonant Progress, between the two Mimicry Tests.

RESULTS

Analysis of Variance

The analysis of variance was made of the responses of 199 subjects to the first ten features of Mimicry Test I, as rated by four judges, including the experimenter. ("Quality" is used to mean "feature".)

Source	d.f.	S.S.	M.S.	F ratio
Judges	3	16,535.49	5,511.797	160.684**
Qualities	9	234,942.49	26,104.721	152.178**
Judges x Qualities	27	14,211.69	526.359	16.988**
Students	198	54,482.40	266.788	
J x S	594	20,375.24	34.302	
Q x S	1782	305,686.89	171.541	
J x Q x S (error)	5346	165,646.43	30.985	
Total	7959			

** Sign. at x - .01 level of significance

The agreement among the four judges was considered insufficient to justify the use of average judgments in making the correlations with auditory discrimination test scores. Since it was assumed that this lack of agreement was largely due to inadequate training of the judges in the rating criteria demanded by the experimental design, it was decided that the correlations should be made using only the ratings made by the experimenter.

Correlations Between Discrimination and Mimicry Ability

Although the Mimicry Test consisted of twenty features testing different patterns of French intonation, rhythm, vowels, and consonants, it was thought desirable--for the purposes of this study--to combine a given subject's scores for these twenty features into four mean scores, corresponding to just those phonetic categories involved, i.e., intonation, rhythm, vowels, and consonants. Mean scores in these four categories from the Mimicry Test given at the beginning of the year were used as dependent variables (designated Y1, Y2, Y3, Y4) in a set of four multiple correlations, using the scores from the four discrimination tests as independent variables (designated X1, X2, X3, X4). Coefficients of correlation were obtained as follows:

Y1: Intonation Mimicry		Y3: Vowel Mimicry	
X1: Tonal Memory	.219	X1: Tonal Memory	.196
X2: Sense of Rhythm	.180	X2: Sense of Rhythm	.252
X3: Vowel Recognition	.099	X3: Vowel Recognition	.063
X4: Phonemic Differentiation	.085	X4: Phonemic Differentiation	.055

Y2: Rhythm Mimicry		Y4: Consonant Mimicry	
X1: Tonal Memory	.278	X1: Tonal Memory	.061
X2: Sense of Rhythm	.239	X2: Sense of Rhythm	.322
X3: Vowel Recognition	.043	X3: Vowel Recognition	-.209
X4: Phonemic Differentiation	.211	X4: Phonemic Differentation	.239

These are all rather low figures for coefficients of correlation; yet two levels may be distinguished. Nine of these sixteen coefficients range from .180 to .322, while the other seven range downward from .099 to -.209. If we allow the former group to be accepted as "low positive correlations", we may make hypotheses about the relationships of the corresponding tests. The auditory discrimination test that shows the closest relation to the Mimicry Test is that of the sense of rhythm, which has higher coefficients of correlation in all four categories. The next closest relation to the Mimicry Test is shown by the test of tonal memory, which has higher coefficients in three of the four categories. Following that is the test of phonemic differentiation, or Rhyme Test, which has higher coefficients in two of the four categories. The test of vowel recognition, on the other hand, has no coefficients in the higher group and has the only negative coefficient. It may be noted that all the discrimination tests except that of vowel recognition show higher coefficients in that mimicry category that would seem to be the most obviously related, i.e., Intonation with Tonal Memory, Rhythm with Sense of Rhythm, and Consonant with Phonemic Differentiation (which deals specifically with consonant recognition).

It is possible to conclude--within the limitations of the present experimental technique--that the musical abilities tested, sense of rhythm and tonal memory, bear some relation to the ability to mimic French speech patterns. To a slightly lesser extent speech sound discrimination ability, as measured by the Fairbanks Rhyme Test, seems to bear a similar relation to the ability to mimic the foreign sounds. But the tasks involved in recognizing the synthetic vowels produced by the Haskins Laboratories pattern playback appear to be nearly unrelated to mimicry ability.

Correlations Between Discrimination and Progress

According to the original purpose of the Mimicry Test, a student's progress in learning the typical phonetic characteristics of French may be measured by the differences in his mimicry test scores from one testing to another. Because of the large number of subjects involved and the excessive amounts of time required in copying the recordings and rating the performances, the number of times the Mimicry Test was administered in this study was limited to two--once in the fall and once in the spring. It was expected that the period thus elapsed between Mimicry Tests I and II would be sufficient for a reasonable degree of purely pronunciation skill to be acquired by beginning students in an "audio-lingual" course.

The results of the two mimicry tests indicated, however, that progress in the pronunciation skills tested was generally negligible--that those students who mimicked French well in the fall continued to do so (without much real improvement) in the spring and that those who were poor mimics at first remained so. Using only

negligible values for progress, since the difference-scores between Mimicry Tests I and II would thus have only a restricted range close to zero, it did not seem likely that significant correlations could be found. Correlations were made, as planned, between the discrimination test scores and mean scores representing progress between the two mimicry tests. The twenty features of the mimicry test given in the spring were reduced to the same four phonetic categories described above; and the differences between these mean scores and Y1, Y2, Y3, and Y4, respectively, were used as dependent variables (designated Y5, Y6, Y7, Y8) in a second set of four multiple correlations. As before, the scores from the four discrimination tests were used as independent variables. The following coefficients of correlation were obtained:

Y5: Intonation Progress	
X1: Tonal Memory	-.049
X2: Sense of Rhythm	.066
X3: Vowel Recognition	.038
X4: Phonemic Differentiation	-.049

Y7: Vowel Progress	
X1: Tonal Memory	.114
X2: Sense of Rhythm	.039
X3: Vowel Recognition	.058
X4: Phonemic Differentiation	.063

Y6: Rhythm Progress	
X1: Tonal Memory	-.078
X2: Sense of Rhythm	.128
X3: Vowel Recognition	.176
X4: Phonemic Differentiation	-.110

Y7: Consonant Progress	
X1: Tonal Memory	.120
X2: Sense of Rhythm	-.032
X3: Vowel Recognition	.277
X4: Phonemic Differentiation	-.075

Since these figures are generally unsatisfactory coefficients of correlation, no relationships can be adequately hypothesized among the various tests. (Strangely enough, the test of synthetic vowel recognition this time has the two highest coefficients of correlation, .277 for consonant progress and .176 for rhythm progress; but it would probably be rash to make any generalizations from this fact.) Under the conditions of the present experiment, it is necessary to conclude that no relations can be shown to exist between the auditory discrimination abilities tested and the learning of French pronunciation.

CONCLUSION

In this investigation into the learning of French pronunciation and its relation to auditory discrimination abilities, a group of 91 students, who were studying French for the first time, were tested during two successive semesters. The discrimination tests used were two of the Seashore Measures of Musical Talents and two different tests designed to measure speech sound discrimination. A pronunciation test was constructed, using the technique of presenting an unfamiliar model for mimicry, and administered twice--near the beginning and near the end of the year's course.

One element in the experimental design of this study which was to be evaluated is the rating of the mimicry performance. As anticipated, it was both difficult and time-consuming to train even experienced language teachers in making the

arbitrary--and perhaps unnatural--discriminations that are demanded when rating speech performance on a purely phonetic level. (It must be understood that we could not operate on the phonemic level, since we were making distinctions only between the sound systems of the two languages.) The task of rating was itself hard, and the degree of agreement obtained among the raters was unacceptable. Now the question must be raised whether such ratings can ever have any reliability --even when made by the experimenter who constructed the rating scale and conceived the criteria to be followed in rating such phonetic performance.

The results of this study may be summarized as follows:

1) The "scoring" of foreign-language pronunciation tests involving the rating of non-meaningful mimicry is a most complex and hazardous undertaking. An analysis of variance performed on 7,960 observations made by four judges indicates that training in the language and experience in teaching is not enough to insure any agreement in their scoring. The qualifications of a competent judge must no doubt include those same special auditory abilities which are the initial subject of this paper, together with an extensive background in practical phonetics--ear training with unfamiliar languages as well as theoretical study. A panel of such judges might then reach essential agreement in their ratings, with a reasonable period of training in the criteria of the rating scale, with recordings of adequate sound quality, and with a sufficient degree of motivation.

2) Using only the Mimicry Test scores rated by the experimenter, it appears that the musical abilities tested bear some relation to mimicry ability (when the American students mimicking French speech patterns have had no previous experience with French). Ability in speech-sound discrimination was also found to bear a slight relation to the mimicry performance. It must not be assumed, however, that the ability for mimicry by itself is sufficient for perfecting one's pronunciation of a foreign language as an adult. For this reason, while the auditory tests used in this study may predict the ability to mimic French, they do not necessarily predict the ability to make progress in learning French pronunciation.

3) Still using only the Mimicry Test scores rated by the experimenter, there appear to be no relations between the auditory discrimination abilities tested and progress in learning French pronunciation. Whatever the reasons for this result, it must be noted that significant correlations could only be established if there was some reasonable range over which this progress (including no-progress and regress) varied. Since the absolute progress measured during this investigation was consistently near zero, it is suggested that not enough variation occurred in this variable to allow any coefficients of correlation to reach appreciable magnitudes--either positive or negative.

4) To the extent that the actual pronunciation progress made by the subject group was insufficient for carrying out the purpose of this investigation, the implication here for further study is that the time dimension must be expanded to insure that definite changes in the subjects' speech habits take place--either for better or for worse--as long as there is variation. The ideal experimental design should test a group of subjects over a period of two to four years of normal classroom language study or during a shorter period in which intensive training in pronunciation is provided and excellence is demanded.

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PREDICTION OF ACADEMIC ACHIEVEMENT IN FIRST SEMESTER GERMAN

Statement of the Problem

The purpose of this investigation was to study the relationship between selected intellectual and non-intellectual factors and student academic achievement in beginning German classes at Purdue University and thus to determine the predictability of academic achievement by students enrolled in beginning German classes.

Design of the Study

The subjects of this investigation were divided into two groups, a predictor group and a replication group. The predictor group was composed of 1,255 Purdue students who had received a final grade in any first-semester German class during the period beginning 1954-55 and ending with the year 1958-59. The replication group was made up of the 280 students in a beginning class in German in the fall semester of the year 1959-60.

The intellectual variables that were part of the study were: (1) the student's English orientation score, (2) the mathematics orientation score, (3) the previous Purdue Grade Point Index (for those students who had been enrolled at Purdue for one or more semesters), (4) the student's rank in his high school graduating class (normalized in the form of T-scores), and (5) for those students of whom it had been required, the part score in reading and the total score of the German Placement Examination (National Cooperative German Examination, Advanced Form Q), which is required of all students who had had experience with the German language prior to enrolling in a German class at Purdue.

The non-intellectual variables included in the study were: (1) the student's semester rank (1-8), (2) the school of the university in which the student was enrolled, (3) whether or not German was being taken as an elective, (4) sex, (5) the number of credit hours being carried while enrolled in beginning German, (6) the hours of outside employment per week, and (7) the socio-economic status of the family (as determined by the total family income). These last three variables were available only for the replication group.

Not all students had values for all of the above-mentioned variables. Hence, the predictor group was broken down into three sub-groups. The first sub-group included variables that in the future will be readily available for all freshmen entering Purdue. These variables for freshmen were the following: (1) semester rank in college, (2) whether or not German was being taken as an elective, (3) English orientation score, (4) mathematics orientation score, (5) rank in high school graduating class, and (6) sex. There were 1,053 students in this sub-group.

The second sub-group included variables that in the future will be available for most upperclassmen. These variables for upperclassmen were the same as the six variables for freshmen plus (7) the Purdue Grade Point Index prior to enrolling in the first semester German course. There were 860 students in the sub-group.

For the third sub-group, consisting of those students who had had prior German language experience, a third set of variables was used. This set also included the six variables for freshmen plus (7) the German orientation test reading score, and

(8) the German orientation test total score. There were 73 students in this sub-group.

Several additional variables were available for the cross-validation group. These variables, in addition to the seven for upperclassmen, were (8) the student's course load, (9) the hours of outside employment per week, and (10) the socio-economic status of the family. These additional variables were available for 150 of the 280 students in the replication group.

Using coded scores for variables, with the final grade in beginning German at Purdue University (German 101) as the criterion, Pearson product-moment correlations and four separate regression equations were derived to determine the relationship between selected intellectual and non-intellectual factors and student academic achievement, as evidenced by the final grade, in beginning German classes at Purdue University.

Summary of the Findings

Of the six independent variables that made up the freshmen variable sub-group, five correlated positively with the criterion, the final grade in beginning German. Only the elective variables had a negative correlation. The highest correlation was found between rank in high school class and the criteron, .4699, followed by the orientation score in English, .4522, and the mathematics orientation score, .3795. Sex and semester in college correlated only .1162 and .1155, respectively, with the criterion. Whether or not German was being taken as an elective, gave a negative correlation of -.2053.

Intercorrelations of the variables showed that the highest positive correlations were between the English orientation score and high school rank, .4903, and between the English and mathematics orientation scores, .4558. The next highest correlation, numerically, was a negative correlation between the elective variable and semester in college, -.3552.

Using the Wherry-Doolittle Test Selection Method, a method of combining predictor variables which will yield the best possible multiple correlation between the selected variables and the criterion, resulted in the selection of a combination of four variables with an R^2 of .29988. These four variables, in the order selected, were high school rank, English orientation score, whether or not German was being taken as an elective, and the mathematics orientation score. All of these, when tested for the significance of the additions to R^2, were significant at the .01 level. However, since the last variable selected, the mathematics orientation score, raised the R^2 by only .00969, it was omitted from further statistical computation. Thus, a multiple regression equation for these freshmen variables was to consist of rank in high school, English orientation score, and whether or not German was being taken as an elective.

Of the upperclass variables, six were found to be positively correlated with the criterion and one negatively correlated. The highest positive correlation with the criterion was found for the previous Purdue Grade Point Index, .5109, followed by high school rank, .4627, English orientation score, .4434, and the mathematics orientation score, .3468. Sex and semester in college correlated .1644 and .0519,

respectively. The elective variable once again correlated negatively with the criterion, -.1964.

The highest positive variable intercorrelations were between the previous Purdue Grade Point Index and high school rank, .5618, between high school rank and the English orientation score, .5361, and between high school rank and the mathematics orientation score, .4818.

For a combination of best possible predictors for this sub-group of variables the Wherry-Doolittle procedure selected four variables with an R^2 of .34620. These four variables, in the order selected, were Purdue Grade Point Index, the English orientation score, high school rank, and sex. Of these four, the sex variable was the only one not significant at the .01 level when tested for the significance of the addition to R^2. Hence, the multiple regression equation for this variable sub-group was to consist only of the Purdue Grade Point Index, English orientation score, and high school rank.

In the regression based on high school German variables, the elective variable again correlated negatively with the criterion, -.1904. The other variables ranged in correlation from .4792 for high school rank to .0558 for semester in college. High school rank was followed by the mathematics orientation score, .4086, English orientation score, .3533, German orientation reading, .3295, German orientation total, .2369, elective, -.1904, sex, .0705, and semester in college, .0558.

Variable intercorrelations were highest between the reading section score of the German orientation test and the total scaled score, a correlation of .8290. The next highest correlations were between the mathematics orientation score and high school rank, .4217, and between high school rank and the English orientation score, .3396.

For this sub-group of variables, the Wherry-Doolittle procedure selected seven predictor variables. These were, in order of selection, high school rank, German reading test score, elective, English orientation score, mathematics orientation score, German orientation test total score, and semester in college. The R^2 for this group of predictors was .42268. When these variables were tested for their additions to R^2, only high school rank was significant at the .01 level. The German reading test score, elective, and English orientation score were all significant at the .05 level. Since the other variables were not statistically significant at these levels, the regression equation was made to consist of high school rank, German reading test score, elective, and the English orientation score.

The fourth regression, based on the upperclass variables plus three additional variables available only for the replication group, was performed merely to see if the three additional variables, namely course load, number of hours of outside employment per week, and socio-economic status of the family, would give better correlations than the other variables used in the first three regressions. These three additional variables correlated only .0619, .0466, and .0417, respectively, with the criterion. In this regression, too, the elective variable correlated negatively with the criterion, -.1891. Once again the best correlation was found between the rank in high school and the criterion, .4543, followed by English orientation score, .4190, Purdue Grade Point Index, .3658, and mathematics orientation score, .2669. The highest variable intercorrelation was between high school rank and Purdue Grade Point Index, .5019.

The Wherry-Doolittle procedure selected four variables for prediction purposes from this sub-group of variables. They were, in the order selected, high school rank, English orientation score, Purdue orientation score, Purdue Grade Point Index, and the mathematics orientation score. Since the R^2 for these four variables was only .31063 and did not improve the previous R^2's, no further statistical computations were undertaken for these variables.

The regression based on high school German variables was also eliminated from further statistical computation, after it was found that an equation based on these variables could be used for only twelve students in the replication group. Since the first regression equation, based on the freshmen variables, could be used to predict grades for 232 students, and the upperclass variable regression equation could be used for 192 predictions, only these two equations were used for the prediction of student academic achievement.

The regression equation based on the freshmen variables predicted the final grades in beginning German for 232 students of the replication group. These predicted grades correlated .57 with the actual grades attained. This correlation of .57 represented an efficiency of prediction 17.84% better than chance prediction and accounted for 32.49% of the criterion variability.

This freshmen variable regression equation accurately predicted no A grades, approximately 35% of the B grades, 70% of the C grades, 35% of the D grades, and only 4% of the F grades.

The regression equation based on upperclass variables predicted the final grades in beginning German for 192 of the students in the replication group. These predicted grades correlated .56 with the actual grades earned. This correlation of .56 represented an efficiency of prediction 17.15% better than chance prediction and accounted for 31.36% of the criterion variability.

This upperclass variable regression equation accurately predicted no A grades, approximately 45% of the B grades, 70% of the C grades, 14% of the D grades, and only 3% of the F grades.

In order to achieve the purpose of this investigation, four null hypotheses were formulated. These hypotheses served as a guide in making basic judgments that were related to this study. The four null hypotheses tested were:

1. There is no relation in the population sample, as shown by coefficients of correlation, simple and multiple, between selected intellectual factors and student academic achievement in first semester German classes.

2. There is no relation in the population sample, as shown by coefficients of correlation, simple and multiple, between selected non-intellectual factors and student academic achievement in first semester German classes.

3. There is no relation in the population sample, as shown by coefficients of correlation, simple and multiple, between a combination of selected intellectual and non-intellectual factors and student academic achievement in first semester German classes.

4. There is no relation, as shown by a correlation coefficient, between a predicted grade, using a combination of selected intellectual and non-intellectual factors, and student academic achievement in first semester German classes.

The first null hypothesis postulated above was rejected on the basis of statistically significant correlations between the five intellectual factors and the criterion. All correlations were statistically significant at the .01 level. These variables were: (1) high school rank in graduating class, (2) English orientation score, (3) mathematics orientation score, (4) Purdue Grade Point Index, (5) German orientation test reading score, and (6) the German orientation test total score.

The second null hypothesis was also rejected. All correlations for the non-intellectual variables were statistically significant at the .01 level. Although the correlations of the non-intellectual variables with the criterion were low, these correlations did show some relationship.

The third null hypothesis was also rejected. It was rejected on the basis of the statistically significant additions to R^2 for the variables selected by the Wherry-Doolittle procedure for prediction purposes. All additions were significant at either the .01 or .05 level.

The fourth null hypothesis was also rejected on the basis of statistically significant correlations between the four combinations of selected intellectual and non-intellectual factors and the criterion, i.e., the final grade in beginning German. All correlations were statistically significant at the .01 level. Although the decision was made to base predictions for the replication group on two regression equations only, one of which did not make use of a non-intellectual factor in its final predictive form, all four of the regression equations formulated by the Wherry-Doolittle Test Selection Method used combinations of both intellectual and non-intellectual factors to be used for prediction.

No coefficients of correlations and no regression equations investigated accounted for enough of the criterion variability to make them satisfactory for predicting student academic achievement in beginning German classes.

The best single predictor of student academic achievement in beginning German, was the previous Purdue Grade Point Index. However, this variable was used in only two of the four regressions. High school rank, used in all regressions, was the most consistent predictor. It was the best predictor in three regressions and ranked second to the Purdue Grade Point Index in the fourth.

In the Wherry-Doolittle Test Selection Method, high school rank was again the most consistent variable. In the four regressions formulated, high school rank was selected in the following positions: 1 - 3 - 1 - 1. In the two regressions in which it was included, the Purdue Grade Point Index was selected in positions 1 and 3. The English orientation score, available in all regressions, was selected in positions 2 - 2 - 4 - 2. The mathematics orientation score, also available for all regressions, was selected in the following positions: 4 - not selected - 5 - 4.

Both of the final multiple regression equations used, based on freshmen and upperclass variables, respectively, predicted student academic achievement in beginning German classes with nearly equal success (.57 to .56), although the upperclass regression equation did not accurately predict as high a percentage of final grades in each of the five grade levels.

Conclusions

This investigation undertakes to use intellectual and non-intellectual data available at Purdue for predictive and educational guidance purposes. It is a beginning effort in pursuit of a full scale program for the prediction of student academic achievement in the various courses offered by the Department of Modern Languages. Basic to this investigation is the assumption that the prediction of success in foreign language study is possible. Sectioning of the language classes into ability groups would be a desirable consequence of such investigations. This study may point the way toward future research and better educational guidance for foreign language students at Purdue.

The major conclusions of this study are:

1. The educational guidance of students in beginning German classes may be improved by using background data, intellectual and non-intellectual, that are available prior to enrollment.

2. Such improvement is by no means as great as one might wish, since no single predictor, intellectual or non-intellectual, proved sufficient in itself to predict student success in beginning German.

3. The most efficient single predictor was the Purdue Grade Point Index. However, for those student who had no previous record at Purdue, high school rank was the most effective predictor, followed by the English orientation score.

4. A battery of variables proved to be somewhat more effective than any single variable. Although such improvement was not great, it was sufficient to justify such combinations.

5. The two regression equations utilized for prediction appear not to predict grades of A and F. These two equations do appear to be able to predict such achievement quite accurately at the C grade level and with a lesser degree of accuracy at the B and D grade levels. Further refinements of this predictive procedure appear to be necessary.

6. The predictors may actually be better than they appear to be, due to the lack of knowledge about the reliability of the final grades given by instructors. All methods of measuring reliability entail securing at least two measures with the same instrument or with equivalent forms, and the determination of the relation between them. However, it would be rather impractical to have students repeat the entire first semester course in German in order to obtain two measures of the same instrument. The basic requirements of reliability can not easily be satisfied in this situation. Since the predictability of any instrument is definitely limited when its reliability is low, the predictors in this study may have been affected by the reliability or unreliability of the final grades.

7. Since the data correlating highest with the criterion are available for most students enrolled in all beginning language classes at Purdue University, it appears that this prediction procedure may also be used experimentally, for beginning courses in other foreign languages offered at Purdue.

8. The experimental utilization of this prediction procedure for all beginning language courses offered at Purdue does not eliminate the need for developing predictive procedures for each specific beginning language course.

Implications for Further Study

As a result of the findings in this investigation, the author makes several recommendations for further study in the predicting of student academic achievement in beginning foreign language classes.

1. The reliability might be improved by research using other variables, e.g., motivation, attitude, study habits, personality, and a more complete study of the student's high school background in foreign language study.

2. The procedure developed in this investigation might be used temporarily as a basis for prediction in other beginning language courses. Since, in Indiana especially, a far greater number of high school students have the opportunity to study French and Spanish than German and since the percentage of students who continue to study in college the language started in high school is necessarily greater for French and Spanish, it might be possible to achieve, in a future study, greater predictability by including these two languages.

3. A predictive procedure including student performance during the first four weeks of actual foreign language study as an additional variable might prove to be another predictor. If it were shown to have high predictive value, it might be possible to section beginning language students into ability groups at the end of the first month's actual language study rather than section them before the semester begins.

4. With continued research in beginning German classes and other beginning language classes at Purdue, a combination of prior-to-enrollment prediction procedures and during-the-course prediction procedures might result in more effective prediction and better educational guidance. Such a dual procedure might facilitate early identification of potential over- and under- achievers in foreign language study, a goal which justifies further investigation.

TABLE A

MEANS AND STANDARD DEVIATIONS
OF THE FRESHMEN VARIABLES

N = 1053

Variable	Mean	Standard Deviation
1. Semester in school	3.6952	1.8383
2. Elective	1.7236	.4474
3. English orientation score	66.9715	26.6142
4. Math. orientation score	63.2194	29.0271
5. High school rank	60.3466	8.6678
6. Sex	1.2089	.4067
0. Dependent variable	2.9164	1.2141

TABLE B

INTERCORRELATIONAL MATRIX FOR THE FRESHMEN
INDEPENDENT VARIABLES AND CORRELATIONS WITH THE
DEPENDENT VARIABLE

N = 1053

Variables		r	Variables		r
1	2	-.35221	3	4	.45585
1	3	.03660	3	5	.53131
1	4	.30344	3	6	.18579
1	5	.10781	3	0	.45221
1	6	-.30510	4	5	.49038
1	0	.11550	4	6	-.18051
2	3	-.10270	4	0	.37952
2	4	-.19964	5	6	.20737
2	5	-.18695	5	0	.46678
2	6	.17637	6	0	.11624
2	0	-.20526			

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 0. Final grade in beginning German

TABLE C

MEANS AND STANDARD DEVIATIONS
OF THE UPPERCLASS VARIABLES

N = 860

Variable	Mean	Standard Deviation
1. Semester in school	4.2698	1.4956
2. Elective	1.6721	.4697
3. English orientation score	67.5233	26.6706
4. Math. orientation score	67.8767	26.8786
5. High school rank	60.6977	8.6238
6. Sex	1.1477	.3549
7. Purdue Grade Point Index	4.3829	.8392
0. Dependent variable	4.9791	1.2100

TABLE D

INTERCORRELATIONAL MATRIX FOR THE UPPERCLASS
INDEPENDENT VARIABLES AND CORRELATIONS WITH THE
DEPENDENT VARIABLE

N = 869

Variables		r	Variables		r
1	2	-.25508	3	5	.54608
1	3	.00468	3	6	.19541
1	4	.10328	3	7	.38739
1	5	.06334	3	0	.44337
1	6	-.15841	4	5	.50090
1	7	.12899	4	6	-.07273
1	0	.05199	4	7	.38493
2	3	-.10936	4	0	.34683
2	4	-.12785	5	6	.23293
2	5	-.19283	5	7	.56183
2	6	.12297	5	0	.46267
2	7	-.36301	6	7	.12420
2	0	-.19637	6	0	.16437
3	4	.48177	7	0	.51038

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. Purdue Grade Point Index 0. Final grade in beginning German

TABLE E

MEANS AND STANDARD DEVIATIONS
OF THE HIGH SCHOOL GERMAN VARIABLES

N = 73

Variables	Mean	Standard Deviation
1. Semester in school	2.9041	1.7572
2. Elective	1.8630	.3462
3. English orientation score	58.3699	26.9364
4. Math. orientation score	57.7808	29.1153
5. High school rank	56.9452	8.6697
6. Sex	1.2055	.4068
7. German reading score	42.3699	5.6409
8. German total score	39.7123	4.2048
0. Dependent variable	3.3836	1.0882

TABLE F

INTERCORRELATIONAL MATRIX FOR THE HIGH SCHOOL GERMAN
INDEPENDENT VARIABLES AND CORRELATIONS WITH THE
DEPENDENT VARIABLE

N = 73

Variables		r	Variables		r
1	2	-.36433	3	7	.20950
1	2	-.20757	3	8	.19188
1	4	.42849	3	0	.35330
1	5	.00785	4	5	.42170
1	6	-.43830	4	6	-.36665
1	7	.00923	4	7	.21420
1	8	-.00190	4	8	.24850
1	0	.05581	4	0	.40861
2	3	.12614	5	6	.18830
2	4	-.19040	5	7	.17735
2	5	.05299	5	8	.16834
2	6	.20261	5	0	.47924
2	7	.14009	6	7	.00878
2	8	.11566	6	8	-.09486
2	0	-.19038	6	0	.07047
3	4	.16575	7	8	.82902
3	5	.33956	7	0	.32953
3	6	.25784	8	0	.23692

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. German orientation reading score 8. German orientation total score 0. Final grade in beginning German

TABLE G

MEANS AND STANDARD DEVIATIONS OF THE REPLICATION GROUP VARIABLES

N = 150

Variables	Mean	Standard Deviation
1. Semester in school	4.3066	1.3558
2. Elective	1.6200	.4870
3. English orientation score	70.9599	25.0392
4. Math. orientation score	72.1533	23.5357
5. High school rank	63.1266	7.2835
6. Sex	1.1800	.3855
7. Purdue Grade Point Index	4.5969	.7022
8. Course load	17.4666	1.4899
9. Hours per week employed	4.0066	7.3157
10. Socio-economic status	2.8933	.9976
0. Dependent variable	3.2000	1.1586

TABLE H

INTERCORRELATION MATRIX FOR THE REPLICATION GROUP INDEPENDENT VARIABLES AND CORRELATIONS WITH THE DEPENDENT VARIABLE

N = 150

Variables		r	Variables		r
1	2	-.21868	4	6	-.15099
1	3	.20083	4	7	.27645
1	4	.00946	4	8	.20017
1	5	.01235	4	9	-.04146
1	6	-.11921	4	10	.08901
1	7	.12099	4	0	.26690
1	8	-.00148	5	6	.33582
1	9	.09859	5	7	.50185
1	10	.07895	5	8	.12995
1	0	.07181	5	9	-.07413
2	3	-.02763	5	10	-.04431
2	4	-.01299	5	0	.45431
2	5	-.03918	6	7	.08053
2	6	.15237	6	8	-.13588
2	7	-.31403	6	9	-.03368
2	8	-.27134	6	10	.05018
2	9	-.17260	6	0	.06918
2	10	.09549	7	8	.34416
2	0	-.01896	7	9	.07806
3	4	.30484	7	10	-.09563
3	5	.35477	7	0	.36578
3	6	.11199	8	9	.06880
3	7	.19837	8	10	-.05181
3	8	.08871	8	0	.06199
3	9	.05082	9	10	-.21235
3	10	.05276	9	0	.04660
3	0	.41902	10	0	.04178
4	5	.34960			

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. Purdue Grade Point Index 8. Course load 9. Hours of outside employment per week 10. Socio-economic status of the family 0. Final grade in beginning German

TABLE I

WHERRY-DOOLITTLE PREDICTOR VARIABLES
SELECTED FOR THE FRESHMEN VARIABLES

N = 1053

Variables selected					R^2
1	5				.222188
2	5				.232318
3	5				.275990
4	5				.247761
5	6				.218285
1	3	5			.281103
2	3	5			.290185
3	4	5			.288782
3	5	6			.275995
1	2	3	5		.291269
2	3	4	5		.299884
2	3	5	6		.290828

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex

TABLE J

WHERRY-DOOLITTLE PREDICTOR VARIABLES
SELECTED FOR THE UPPERCLASS VARIABLES

N = 860

Variables selected					R^2
1	7				.261196
2	7				.261137
3	7				.331888
4	7				.287475
5	7				.306080
6	7				.271345
1	3	7			.331888
2	3	7			.332347
3	4	7			.335944
3	5	7			.344280
3	6	7			.335442
1	3	5	7		.344284
2	3	5	7		.344735
3	4	5	7		.345647
3	5	6	7		.346195

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. Purdue Grade Point Index

TABLE K

WHERRY-DOOLITTLE PREDICTOR VARIABLES SELECTED FOR THE HIGH SCHOOL GERMAN VARIABLES

N = 73

Variables selected							R^2
1	5						.232381
2	5						.276365
3	5						.270723
4	5						.281548
5	6						.230076
5	7						.291415
5	8						.254798
1	5	7					.293923
2	5	7					.354599
3	5	7					.318540
4	5	7					.328008
5	6	7					.291605
5	7	8					.298053
1	2	5	7				.356724
2	3	5	7				.390565
2	4	5	7				.371537
2	5	6	7				.356017
2	5	7	8				.361319
2	3	4	5	7			.406189
2	3	5	6	7			.300565
2	3	5	7	8			.398007
1	2	3	4	5	7		.410821
2	3	4	5	6	7		.411066
2	3	4	5	7	8		.416830
1	2	3	4	5	7	8	.422682
2	3	4	5	6	7	8	.419689

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. German orientation reading score 8. German orientation total score

TABLE L

WHERRY-DOOLITTLE PREDICTOR VARIABLES SELECTED FOR THE REPLICATION GROUP VARIABLES

N = 150

Variables selected				R^2
1	5			.210788
2	5			.206407
3	5			.282464
4	5			.219711
5	6			.214242
5	7			.231779
5	8			.206414
5	9			.212887
5	10			.210247
1	3	5		.282535
2	3	5		.282472
3	4	5		.286029
3	5	6		.289910
3	5	7		.305691
3	5	8		.282558
3	5	9		.285815
3	5	10		.284217
1	3	5	7	.305825
2	3	5	7	.309084
3	4	5	7	.307406
3	5	6	7	.310628
3	5	7	8	.309605
3	5	7	9	.307143
3	5	7	10	.308755

1. Semester in school 2. Elective 3. English orientation score 4. Mathematics orientation score 5. High school rank 6. Sex 7. Purdue Grade Point Index 8. Course load 9. Hours of outside employment per week 10. Socio-economic status of the family

TABLE M

MEANS AND STANDARD DEVIATIONS OF THE FRESHMEN PREDICTOR VARIABLES SELECTED BY THE WHERRY-DOOLITTLE TEST SELECTION METHOD

N = 1060

Variable	Mean	Standard Deviation
1. High school rank	60.2887	8.6839
2. English orientation score	66.8764	26.6184
3. Elective	1.7236	.4474
0. Dependent variable	2.9160	1.2166

TABLE N

INTERCORRELATIONAL MATRIX OF THE FRESHMEN PREDICTOR VARIABLES AND CORRELATIONS WITH THE DEPENDENT VARIABLE

N = 1060

Variables		r
1	2	.53346
1	3	-.18738
1	0	.46767
2	3	-.10293
2	0	.45236
3	0	-.20738

1. High school rank 2. English orientation score 3. Elective 4. Final grade in beginning German

TABLE O

MEANS AND STANDARD DEVIATIONS OF THE UPPERCLASS PREDICTOR VARIABLES SELECTED BY THE WHERRY-DOOLITTLE TEST SELECTION METHOD

N = 865

Variable	Mean	Standard Deviation
1. High school rank	60.6393	8.6504
2. English orientation score	67.4427	26.6949
3. Purdue Grade Point Index	4.3801	.8382
4. Dependent variable	2.9768	1.2121

TABLE P

INTERCORRELATIONAL MATRIX OF THE UPPERCLASS PREDICTOR VARIABLES AND CORRELATIONS WITH THE DEPENDENT VARIABLE

N = 865

Variables		r
1	2	.53828
1	3	.56303
1	0	.46557
2	3	.38768
2	0	.44537
3	0	.51112

1. High school rank 2. English orientation score 3. Purdue Grade Point Index
0. Final grade in beginning German

TABLE Q

MEANS AND STANDARD DEVIATIONS OF THE HIGH SCHOOL GERMAN PREDICTOR VARIABLES SELECTED BY THE WHERRY-DOOLITTLE TEST SELECTION METHOD

N = 74

Variable	Mean	Standard Deviation
1. High school rank	56.9324	8.6108
2. English orientation score	58.2838	26.7615
3. Elective	1.8649	.3442
4. German reading score	42.3784	5.6025
5. Dependent variable	3.4054	1.0969

TABLE R

INTERCORRELATIONAL MATRIX OF THE HIGH SCHOOL GERMAN PREDICTOR VARIABLES AND CORRELATIONS WITH THE DEPENDENT VARIABLE

N = 74

Variables		r
1	2	.33975
1	3	.05234
1	4	.17715
1	0	.46993
2	3	.12467
2	4	.20904
2	0	.34321
3	4	.14053
3	0	-.17994
4	0	.32687

1. High school rank 2. English orientation score 3. Elective 4. German orientation reading score 0. Final grade in beginning German

Effect of a Change in Mode of Presentation on Recall in Serial Learning

This experiment employed a factorial design in which 32 Ss practiced by either the aural (tape recorder) or visual (memory drum) method, learned two lists of 11 three-letter words either aurally or visually, and then relearned one list aurally and the other visually. A significant interaction was found between mode of presentation of the learning material and mode of presentation of relearning material; thus the hypothesis that a change in sensory mode of presentation would reduce relearning efficiency was supported. An additional finding was that Ss who learned by the visual method relearned in significantly fewer trials than did those who learned aurally. This effect may have been due in part to the ambiguity of the aural presentation method. An analysis of "recovery" data produced essentially the same results in terms of numbers of words correct for the first three relearning trials--a change in mode of presentation was found to produce less recovery than the same mode of presentation.

The Effect of Changes in Practice and Mode of Presentation on Scores in Recognition Memory

This experiment was designed to determine the effect of changes in practice and sensory mode of presentation on the retention of monosyllabic English words. The design is a 3 x 2 x 2 factorial with repeated measures on people. A total of 48 subjects were employed, with 16 subjects serving under each of the three different practice conditions: visual practice, auditory practice, and no practice. Each subject then learned two lists either aurally or visually and was then tested on one list aurally and the other visually by the recognition method.

The subjects serving under both the auditory practice and no practice conditions committed fewer errors on the recognition tests than did those subjects who received visual practice. This indicates that visual practice may have some type of inhibitory effect on subsequent learning and recognition of verbal materials.

Only words of at least 90 per cent intelligibility were used in the learning lists. Under these conditions the interaction between mode of presentation of the learning material and mode of presentation of the recognition test was not significant at the .05 level. These results indicate that the decrement in retention which has been reported by other investigators may be in part due to the ambiguity of the auditory materials. There is also evidence in the literature that the recognition method is less affected by changes in the sensory mode of presentation than the recall or relearning methods.

The Effect of Differences in Auditory-Discrimination Values on Retention in Serial Learning

This experiment was designed to test the hypothesis that differences in auditory discrimination (A-D) values would have differential effects on the rate of learning and on two measures of retention: recognition memory and active recall. A total of 80 S's were randomly assigned to one of four main groups, which were divided into two sub-groups each. S's in each sub-group 1 received two trials of serial anticipation learning and were tested on recognition; S's in each sub-group 2

received five trials of serial anticipation learning and were tested on active recall. All S's received auditory practice, auditory learning, and were tested for retention aurally.

It was found that the rate of learning was the same for all main groups and recognition was superior to recall, regardless of the list learned. S's who learned list one, which had the highest mean A-D, made fewer error responses in recall than S's who learned the other three lists. S's who learned list 1 had significantly more correct responses on the recognition test than those who learned list 4 which had the lowest mean A-D value. When the recognition test was analyzed more closely, S's who learned list 1 had significantly more errors on the distractors on the recognition test.

It was hypothesized that the associative bonds of word lists containing high A-D value words is greater than that of words of lower A-D values; this accounts for the differences on recognition test scores in favor of the high A-D value lists.

Serial position curves for all groups were also presented; no significant differences appeared.

The Effect of Varying Word Associative Latency upon Auditory Serial Learning and Retention

Two experiments were conducted to determine the effect of varying word associative latency upon auditory serial learning and retention. In Experment I, 25 male and 5 female subjects made free associations to 300 three-letter, monosyllabic, CVC words. The subjects' word associative latencies to each word were measured, and the mean latencies and standard deviations for each word were computed over all subjects. Significant differences in latency were observed among the words.

Experiment II employed the mean latencies obtained in Experiment I in the construction of three, twelve-word learning lists of differing mean latency--short, medium, or long--to test two hypotheses:

a) No differences exist in rate and difficulty of learning among word lists of differing mean latency vs. the alternative hypothesis that such differences do exist.

b) No differences exist in amount of retention for lists of differing mean latency vs. the alternative hypothesis that such differences do exist.

Experiment II employed a 2 x 3 factorial design--measure of retention (recall or savings) x list latency (short, medium, or long), with no repeated measures. A group of 7 subjects was randomly assigned to each experimental condition. Of the 42 subjects, 25 were males and 17 were females.

Each subject first learned a seven-word practice list and then one of the three, twelve-word learning lists by the auditory, serial anticipation method to a criterion of one perfect repetition. After a 10 minute retention period, the subjects were tested for retention by one of the two methods of retention.

An analysis of variance made on the learning data revealed that the long latency list was learned at a slower rate than either the medium or short latency lists. The long latency list was more difficult to learn than either the medium or short

latency lists. No significant differences were found between the short and medium latency lists.

An analysis of the main effects made on the retention scores in the factorial experiment revealed no significant effects for either of the factors, nor was a significant interaction obtained. The failure to obtain significant differences in retention may be attributed to the rather severe criterion during learning and the short length of the retention period.

Mann-Whitney U tests made on the Thorndike-Lorge (1944) frequencies of the words in the three learning lists, revealed that the lists also differed significantly in frequency, as well as in word associative latency.

The Effects of Varying Auditory Characteristics on Aural Serial Learning

The purpose of this investigation is to determine the effects on learning of four differently constructed lists of words. The lists were constructed on the basis of four different auditory criteria, (1) the frequency of the word's appearance in spoken English (2) Hilgard's modification of Muller's rules for constructing nonsense syllable lists (3) the relative frequency of the appearance of each individual phoneme in the English language producing a phonetically balanced list (4) composed of words selected at random from the dictionary.

A practice 10 item CVC list was administered to each of 40 Ss. Error scores were recorded for these and served as a basis for matching 4 groups of 10 Ss each. Ss were then presented aurally one of the four experimental lists for a maximum of 10 trials.

The following results were obtained:

1. The list of most commonly spoken CVC was learned more rapidly than the randomly selected or p-b lists.
2. The data indicated a trend for the list constructed under nonsense syllable rules to be learned more rapidly than the random or p-b lists.
3. It was, therefore, concluded that lists of words used most frequently in ordinary conversation are more easily learned than others. The frequency of use in conversation is not the same as frequency in the T-L magazine count.
4. Serial position effects were noted.